Journal of Comprehensive Surgery

Original Article

DOI: 10.51271/JOCS-0040

Comparison of early and late term results of onlay and sublay mesh approaches in open incisional hernia surgery

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Cite this article: Kılavuz H, Güngör F, Demir M, Kurtuluş İ. Comparison of early and late term results of onlay and sublay mesh approaches in open incisional hernia surgery. *J Compr Surg.* 2024;2(4):72-75.

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Received: 12/08/2024 ◆ **Accepted**: 17/10/2024 ◆ **Published**: 28/11/2024

ABSTRACT

Aims: Despite the increase in minimally invasive techniques, open techniques continue to be frequently used in incisional hernia repairs. In open incisional hernia surgeries, onlay and sublay techniques are the most frequently preferred depending on the area where the mesh is placed. In this study, we aimed to compare these two techniques by analyzing perioperative findings.

Methods: Data from elective open incisional hernia surgeries (onlay and sublay) performed by the same surgical team in the general surgery clinic between 01.01.2023 and 31.12.2023 were retrospectively reviewed. Emergency surgeries, laparoscopic or combined surgeries, patients who did not undergo mesh repair, patients who received preoperative botulinum toxin due to "loss of domain", patients with missing data, and patients who did not continue their follow-up were excluded from the study.

Results: The data of a total of 74 patients who met the inclusion criteria were analyzed in the study. Onlay procedure was performed in 53 (71%) patients and sublay procedure was performed in 21 (19%) patients with a retromuscular approach. No intraoperative complications were detected in any of the patients. There were statistically significant differences between the groups in terms of female gender (p: 0.007), duration of surgery (p<0.001) and duration of hospital stay (p<0.001). There were no statistically significant differences between the groupsin terms of complications (p: 0.42), unexpected re-admission (p: 0.779) and six-month recurrence (p: 0.779).

Conclusion: Onlay or sublay techniques can be safely applied in open incisional hernia surgery because they have acceptable complication and recurrence rates. Surgical experience and patient factors are the main determinants of which technique to apply.

Keywords: Incisional hernia, mesh repair, onlay, sublay

INTRODUCTION

The use of minimally invasive techniques for abdominal surgery has been increasing in recent years. However, laparotomies continue to be performed in many abdominal surgeries, especially emergency procedures.[1] The incidence of incisional hernias (IH), a common complication after laparotomies, varies between 2% and 20%.[2,3] Many risk factors have been reported for incisional hernias. Patient-related factors include age, obesity, malnutrition, anemia, diabetes, smoking, chronic obstructive pulmonary disease, and immunosuppression. Technical factors include the location of the incision, the type of suture material used, surgical site infection, and the type of fascial closure.[1,4]

Incisional hernias, which are usually asymptomatic, can cause serious complications such as abdominal pain, intestinal obstruction, and enterocutaneous fistula. Therefore, there are studies recommending fascial closure with a small bite technique and prophylactic mesh reinforcement of the midline to reduce the likelihood of incisional hernia development in laparotomy closure.[5,6] Incisional hernias are associated with decreased quality of life and high socioeconomic costs. Patients who undergo IH repair may be exposed to the risks of reoperation due to the high recurrence rate. Recurrence rates after IH surgeries are reported to range from 23% to 50%.[7] Surgical options for IH repair include primary repair with sutures without mesh or open or laparoscopic repairs with mesh. In mesh repairs, onlay and sublay repairs are frequently preferred procedures depending on the area where the mesh will be placed. However, there is no definitive consensus on which technique is superior.[8]

The main goal in all hernia surgeries should be to apply a method that minimizes the possibility of recurrence and has minimal complications. Therefore, in our study, we aim to compare onlay and sublay mesh placement techniques in open surgeries for incisional hernias.

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METHODS

Ethics

The thesis study was initiated with the approval of the Başakşehir Çam and Sakura City Hospital Clinical Researches Ethics Committee (Date: 08/2024, Decision No: 197). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. Due to its retrospective nature, only surgical informed consent forms were obtained from the patients.

Patient Selection

Patients who underwent open approach, onlay and sublay techniques in elective incisional hernia surgeries performed consecutively between 01.01.2023 and 31.12.2023 by the Surgery 3 Unit, which is a hernia-specific team within the general surgery clinic of our hospital, which is a tertiary health center, were retrospectively screened and included in the study. The technique to be used was determined by the surgeon's preference, without randomization based on the patient's characteristics and the size of the hernia.

Inclusion criteria: Patients over the age of 18 who have a hernia defect smaller than 10 cm, undergo elective incisional hernia repair (onlay or sublay) and are followed up for six months after surgery.

Exclusion criteria: Emergency surgeries, laparoscopic or combined surgeries, patients who did not undergo mesh repair, patients who received preoperative botulinum toxin due to "loss of domain", patients with missing data, and patients who did not continue their follow-up were excluded from the study.

Gender, age, body-mass index (BMI), comorbidity status, location of incisional hernia, applied surgical technique (onlay/sublay), duration of surgery, complication status, length of stay, unexpected admission and six-month postoperative recurrence status were analyzed from the data scanned retrospectively from the digital archive on the hospital information management system.

Surgical Method

Onlay technique: After the incisional hernia area is released and adhesions are removed, the abdominal defect is closed with a number 0 Polydioxanone (PDS) suture. A polypropylene mesh is prepared according to the size of the area and placed on the anterior abdominal aponeurosis, prefascial region. A hemovac drain is placed on the area above the mesh and the subcutaneous tissue and skin are closed.

Sublay technique: Also known as the Rives-Stoppa technique. After the hernia area is released and adhesions are removed, the plane between the rectus abdominis muscle and the posterior leaf of the rectus sheath is dissected. After the posterior defect is closed with a number 0 PDS suture, a polypropylene mesh is prepared according to the size of the area and laid on the retrorectus plane to fix it. Hemovac drains are placed and the midline defect is closed with a number 0 PDS suture. Finally, the subcutaneous and skin are closed.

In both procedures, vacuum drains were removed when daily drainage fell below 30 ml. Routine outpatient clinic checks were performed in the first and second weeks and the first, third and sixth months postoperatively.

Statistical Analysis

SPSS 25.0 (SPSS Inc, Chicago, IL, USA) analysis program was used for statistical evaluation of the data. Descriptive statistical methods (frequency, percentage, mean, standard deviation) and Pearson Chisquare, Fisher Chi-square or Yates Chi-square tests were used to compare quantitative data. The conformity of the data to normal distribution was performed with the KolmogorovSmirnow test. In the study, independent samples-t test was used in the evaluation of quantitative data showing normal distribution; values less than p=0.05 were considered significant and significant difference between groups.

RESULTS

The data of a total of 74 patients who met the inclusion criteria were analyzed in the study. In terms of gender distribution, 46 (62%) were female and 28 (38%) were male. The mean age was 55±12, and the mean BMI was 30±3.8. Twenty-five (33%) of the patients had comorbidities. Recurrent incisional hernia surgery was performed in 14 (19%) patients. Onlay procedure was performed in 53(71%) patients and sublay procedure was performed in 21 (19%) patients with a retromuscular approach. No intraoperative complications were detected in any of the patients. No postoperative complications were observed in 41 (78%) of the patients who underwent onlay repair and 18 (86%) of the patients who underwent sublay repair. Serous wound discharge and hematoma observation rates were 13%/7.5% in the onlay group and 5%/5% in the sublay group, respectively. All of these complications resolved with conservative follow-up. There were statistically significant differences between the groups in terms of female gender, duration of surgery and duration of hospital stay. There were no statistically significant differences between the groups in terms of complications, unexpected re-admission and six-month recurrence (Table). No re-intervention was performed in any patient during the follow-up period and no mortality was observed.

Table. Distribution of demographic data and perioperative findings between groups

	Group		p value
	Onlay (n=53)	Sublay (n=21)	
Age*	54.3 (44.5-64)	57.6 (51-65)	0.247
Gender (female), n (%)	38 (71.6)	8 (38)	0.007
Preoperative recurrence status, n (%)	9 (16.9)	5 (23.8)	0.499
Comorbidity (yes) %	14 (26.4)	11 (52.3)	0.063
BMI*	30.2 (28-32)	30.68 (28-33)	0.564
Duration of surgery (min)*	82.03 (52.5-95)	180.7 (140-217.5)	<0.001
Hospital stay (days)*	2.98 (2-4)	5.9 (5-6.5)	<0.001
Complication (yes)%	12 (22.6)	3 (14.2)	0.420
Unexpected re-admission, n (%)	4 (7.5)	2 (9.5)	0.779
Recurrence within 6 months, n (%)	2 (3.7)	1 (4.7)	0.846

BMI: Body-mass index, *mean (Q1-Q3)

DISCUSSION

In recent years, as in many other surgeries, laparoscopic and robotic surgeries have become a trend in incisional hernia surgeries. Due to the high incidence of incisional hernias, this situation does not reduce the need for open surgical

approaches. In our study, we found that open approach onlay and sublay techniques were successfully applied in incisional hernia repair without any significant superiority over each other.

Basta et al.[9] analyzed 30,000 abdominal surgeries and found an incidence of IH of 3.8% over a 5-year follow-up. The procedures most commonly associated with the development of IH were colorectal (7.7%), vascular (5.2%), bariatric (4.8%), and organ transplant surgery (4.5%). In IH open surgeries, the name is made according to the area where the mesh is placed. In particular, researchers who prefer open approaches in IH repair in the literature compare onlay and sublay repairs. The parameters that researchers focus on when comparing both techniques are seroma rate, surgery time, hospital stay and recurrence rate in postoperative follow-up. Demographic data, especially in terms of gender and age, showed differences between the studies. In one study with a male-female ratio of 0.6:1, the mean age was 45.4±12.29, while another study with a female ratio of 58% included an older population and reported a mean age of 65.5.[2,10] In our study, the female rate was 62% and the overall mean age was 55±12. While no statistically significant difference was observed between the groups in terms of age, a significant difference was detected in terms of gender.

Acar et al.[8] reported that 24.3% of patients who underwent surgery for incisional hernia had comorbidities, particularly diabetes, hypertension, and obesity. In another study, no statistically significant difference was shown between the groups in terms of concomitant diseases.[11] Similarly, in our study, while there was no significant difference between the groups in terms of comorbid diseases, the presence of comorbid diseases was determined as 33%. The most important consequence of the presence of comorbid diseases is that the duration of hospitalization can be prolonged due to these diseases or as a result of the disruption of wound healing.

Onlay technique has a time advantage due to standard anatomy and preparation of a single area for mesh placement. In the study of Hassan et al.,[10] the mean intraoperative time for onlay and sublay repair was 88.1±31.39 and 104.9 ±39.41, respectively, and was found to be statistically significant. In a study where the groups were similar in terms of age and gender, the duration of surgery was found to be significantly shorter in the onlay group than in the sublay group. However, the mean length of hospital stay was similar in both groups.[12] In our study, both the operation time and the hospital stay were longer in the sublay group and there was a statistically significant difference between the two groups. We believe that this is due to being a training hospital and the close relationship between retromuscular anatomical orientation and experience. On the other hand, Pereira et al.[2] in their study associate the longer hospital stay in the onlay group with the seroma rate in the onlay group.

Seroma formation is a common complication after open mesh repair, with an incidence of 30% to 50%. The exact pathophysiology of seroma formation is unknown. However, some studies suggest that seroma occurs more frequently with the onlay technique due to greater dissection of the subcutaneous tissue and contact with the mesh.[13] Due to its technical simplicity, onlay mesh placement can be considered the preferred method of mesh repair for surgeons who do not routinely perform retrorectus dissection.[14] Although there are studies[2,10,15] that detected seroma formation more frequently in the onlay group than in the sublay group, Martins et al.[11] detected seroma formation more frequently in the sublay technique. They stated that the reason for this situation was the lower drain placement rate in this group. Recent meta-analyses report that there is no difference in seroma development between sublay and onlay techniques.[16]

The wound infection rate after IH repair has been reported as 6-12%, and its etiology is associated with extensive dissection of the subcutaneous tissue and mesh material.[17] Therefore, in studies, the onlay technique has been associated with an increased risk for infectious complications due to the position of the mesh.[14] In a meta-analysis comparing sublay and onlay incisional hernia repair by Timmermanns et al.,[18] fewer surgical site infections were found in favor of the sublay technique. Similarly, Pereira et al.[2] found a high rate of seroma and surgical wound infection in those who underwent the onlay technique. In our study, the serous wound discharge rate was 13% in the onlay group and 5% in the sublay group. No significant difference was found between the groups in terms of general complications. However, the lack of a clear definition of seroma in the data creates confusion in terms of determining the incidence of seroma. We also believe that the use of surgical drains reduces the detection of symptomatic seroma. The role of drains in open incisional hernia repair and their ability to reduce seroma is not yet clear in the current literature. Therefore, more comprehensive studies are recommended to evaluate the role of drains in open incisional hernia repair.[19]

Postoperative follow-up periods for recurrence detection are not standard in the studies. There are studies that present the results of postoperative thirty days, the first six months, or approximately five years of follow-up.[10-12,20] Venclauskas et al.[21] reported a recurrence rate of 10.5% in onlay mesh repair and 2% in sublay mesh repair. In their study comparing inlay, onlay and sublay groups, de Vries Reilingh et al.[22] reported the recurrence rates at 12-month follow-up as 28.3%, 44% and 12%, respectively. Contrary to these studies, there are also studies showing that there is no difference in recurrence between the two groups.[10,12] Similarly, in our study, no significant difference was found between the groups in terms of recurrence in the six-month period. In a study reporting a general complication rate of 13%, it is emphasized that hospitalization is not required because all complications are minor.[20] This is consistent with the absence of major complications in our results. Therefore, no patient required rehospitalization during the postoperative period.

Limitations

Due to its retrospective design, our study had some limitations. The most important limitation was that all patient follow-up data were not entered into digital information management systems due to personnel shortages. Another major limitation was the low number of patients in the groups. The main reason for this can be explained as the increasing interest in laparoscopic surgery. If a high-volume study is desired, the desired numbers can only be achieved with multicenter studies.

Although most studies in the current literature indicate that the onlay technique is associated with wound complications, seroma rates, and recurrence rates compared to the sublay

technique, we obtained different results from the literature in our study population. Most of the studies on large patient numbers are meta-analyses. However, we believe that studies that include larger patient numbers in a randomized population and longer follow-up periods will contribute more to the literature.

CONCLUSION

Onlay or sublay techniques can be safely applied in open incisional hernia surgery because they have acceptable complication and recurrence rates. Surgical experience and patient factors are the main determinants of which technique to apply.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Başakşehir Çam and Sakura City Hospital Clinical Researches Ethics Committee (Date: 08/2024, Decision No: 197).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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